REMARKS

Claims 1-19 are pending. Claim 1 is amended. Claims 15-18 are withdrawn from consideration. Claim 19 is new.

Claim Amendments

Claim 1 has been amended to correct a minor typographical error.

New claim 19 is similar to claim 1, but recites a homogenization heat treatment and states that the temperature T is not more than 20°C below a burning temperature of the alloy or a lowest burning temperature of the different alloys. Claim 19 is fully supported by the original claims and specification.

No new mater has been added to the claims.

Declaration under 37 C.F.R 1.132

Applicant submits herewith a declaration by Dr. JC Ehrstrom, a named inventor of the present application. The Declaration concerns the nonobviousness of the claimed invention in view of the Litwinski and Rioja et al. patents asserted by the Examiner.

Claims Rejections – 35 U.S.C. §103

Claims 1-14 were rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over either Litwinski (US patent No. 6,780,525) in view of Rioja et al. (US Patent No. 4,861,391). This rejection is respectfully traversed for at least the following reasons, which are also explained in detail in the attached Declaration.

The present application is directed to a method for manufacturing aluminum alloy parts joined by friction stir welding, wherein solution heat treatment and quenching of the welded part is carried out. In such a method, average grain size in the weld and heat affected zones may be considerably increased during solution heat treatment due to the high amount of energy stored in these zones. The claimed invention, as recited in claim 1, employs a heat treatment

(homogenizing and/or intermediate heating and/or treatment of partly finished product) before friction stir welding and with a duration significantly longer than the normal homogenization or solution heat treatment duration for the same alloy. Specifically, this heat treatment is conducted at a temperature T for at least $2t_1$, wherein t_1 comprises a minimum treatment duration at temperature T leading to a specific melting peak energy defined by Differential Scanning Calorimetry of less than 1 J/g.

Specific melting energy is the energy needed to obtain local melting at a "burning temperature." The "burning temperature" is better known as the "incipient melting temperature." For aluminum alloys, the burning temperature is never below 400 °C. The temperature T is as close as possible to the burning temperature of the alloy. In this regard, claim 4 specifies that the temperature T is less than the alloy burning temperature by not more than 20°C, or if different alloys are used, the lowest burning temperature of these alloys.

Homogenizing or solution heat-treating enables soluble phases dissolution. Once the soluble phases have dissolved, local melting is strongly reduced or avoided. Normal homogenization or solution heat treatment duration (t_1, recited in claim 1) corresponds to the time needed for the dissolution of soluble phases. Differential Scanning Calorimetry (DSC) is a tool used to control the quality of phase dissolution, and a specific melting peak energy defined by DSC less than 1 J/g is a common criteria. In the claimed invention, the duration of the claimed heat treatment is significantly increased not only in order to obtain dissolution of soluble phases, but also to obtain coalescence of dispersoids which the present inventors have found to produce fine grains after solution heat treatment of the friction stir welded part.

Litwinski teaches solution heat treatment before and after friction stir welding. However, Litwinski does not teach a heat treatment before friction stir welding with a duration twice as long as the normal homogenization or solution heat treatment duration for the same alloy, as recited in the present claims. To the contrary, in Figure 4B in column 7 lines 35 to 40, Litwinski teaches normal homogenization or solution heat treatment duration. More specifically, t_1 from Figure 4Bis defined by Litwinski as a "a sufficient period of time to allow the β phase to dissolve." Litwinski teaches a different method to control grain size after friction stir welding

and solution heat treating the welded part, namely, heating the friction stir weld tool prior to and during the forming step of the weld joint (column 4 lines 10 to 13).

Rioja et al. mainly disclose aging heat treatments. Aging enables precipitation hardening by controlled precipitation of the dissolved elements. Precipitation hardening of phases occurs at much lower temperatures than soluble phase dissolution, and is generally not carried out above 250°C. In the Rioja et al. patent, DSC is used to characterize precipitates formed or dissolved during aging, and is not used to characterize specific melting energy, as recited in the claimed invention.

Based on the above, there is not teaching or suggestion in the Litwinski or Rioja et al. patents to employ a heat treatment at a temperature T for at least $2t_1$, wherein t_1 comprises a minimum treatment duration at temperature T leading to a specific melting peak energy defined by Differential Scanning Calorimetry of less than 1 J/g. Furthermore, the Rioja et al. patent is not concerned with heat treatment to obtain soluble phase dissolution, and does not teach or suggest that DSC be employed in the claimed manner with respect to heat treatment for soluble phase dissolution. Therefore, one of ordinary skill in the art would not be motivated to combine the Rioja et al. disclosure with regard to aging treatment to the disclosure of Litwinski with regard to dissolution of soluble phases to arrive at the claimed method.

Furthermore, as stated above, the heat treatment step specified in claim 1 results in the coalescence of dispersoids, which in turn produces fine grains after solution heat treatment of the friction stir welded part. There is no recognition or suggestion in the prior art that extending the normal treatment duration during soluble phase dissolution, as recited in claim 1, produces such a result.

For at least the above reasons, claims 1-14 are allowable over Litwinski and Rioja et al. Claim 19 is similar to claim 1, and is believed to further patentably distinguish.

Conclusion

In view of the above amendment and foregoing remarks, Applicants believe the pending application is in condition for allowance.

If a fee is due, please charge our Deposit Account No. 11-0553, under Order No. 2901683.19, from which the undersigned is authorized to draw.

Dated: October 29, 2007

Respectfully submitted,

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